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10/519,107	12/23/2004	Yoshiyuki Suzuri	04890/HG	9443
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EXAMINER NELSON, MICHAEL E				
ART UNIT		PAPER NUMBER		
1794				
MAIL DATE		DELIVERY MODE		
09/22/2008		PAPER		

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/519,107

Applicant(s)

SUZURI ET AL.

Examiner

MICHAEL E. NELSON

Art Unit

1794

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 July 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-36 is/are pending in the application.
- 4a) Of the above claim(s) 6, 7, 9-15, 17, 19-28, 30 and 31 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-5, 8, 16, 18, 29, 32-36 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/808)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 08/21/2008 has been entered.

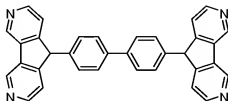
Status of Claims

2. Claims 1-5, 8, 16, 18, 29, 32-36 are pending. Claim 1 has been amended. Claims 7, 9-15, 17, 19-20, 22-28, 30-31 are withdrawn from consideration as being directed towards a non-elected species. Examiner notes that claims 6 and 21 have an incorrect status identifier, and should also be listed as withdrawn as being directed towards a non-elected species.

Election/Restrictions

3. For purposes of clarity, the elected species is shown below. Claims which read on the elected species are under examination. Other claims are currently withdrawn from consideration. For purposes of expediting prosecution, art which applies to claims encompassing the elected species, but does not necessarily include the elected species

specifically is included. Art may also apply to withdrawn claims, but those claims are not addressed in the present action.



Claim Rejections - 35 USC § 102

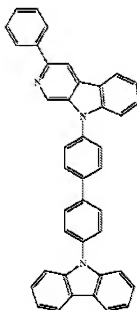
4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 1-5, 32-34, and 36 are rejected under 35 U.S.C. 102(e) as being anticipated by Iwakuma et al. (US 2004/0086745).
6. Concerning claims 1-5, Iwakuma et al. describe organic electroluminescent devices comprising an anode and a cathode and an organic layer between the anode and cathode. [0052] The organic layer comprises a material such as the one shown below. [0052] The device emits bluish light (per claim 34) [0054], and is preferably a host material for a phosphorescent light emitting material [0057] (in the light emitting layer, per claim 32), with a high triplet energy gap (suitable for a blue phosphorescent

material). [0057] The material may further be used in a hole barrier layer (hole blocking layer, per claim 33). [0064]



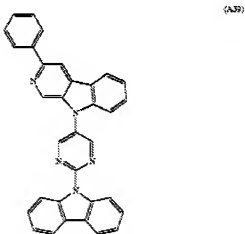
{A55}

7. This material meets the requirements of Applicant's formula (1) where Z_1 is an aromatic heterocyclic ring (6-membered, per claim 2), Z_2 is an aromatic hydrocarbon ring (6-membered, per claim 3), and Z_3 is a single bond (per claim 4). R_{101} is an aryl group, specifically a biphenyl group. The molecular weight is 561.7 (per claim 5).

8. Concerning claim 36, Iwakuma et al. disclose that organic EL devices are useful for applications such as full color displays. [0002] In fact, it is the fundamental goal of research in organic electroluminescence to produce display devices. Therefore one of ordinary skill would immediately envisage display devices using the electroluminescent devices described by Iwakuma et al.

9. Claims 1-5, 32-34, 36 rejected under 35 U.S.C. 102(e) as being anticipated by Iwakuma et al. (WO 2003078541) based on English language equivalent (US 2005/0127823).

10. Concerning claims 1-5, Iwakuma et al. describe organic electroluminescent devices comprising an anode and a cathode and an organic layer between the anode and cathode. [0019] The organic layer comprises a material such as the one shown below. [0019] The device emits bluish light (per claim 34) [0020], and is preferably a host material for a phosphorescent light emitting material [0023] (in the light emitting layer, per claim 32), with a high triplet energy gap (suitable for a blue phosphorescent material). [0023] The material may further be used in a hole barrier layer (hole blocking layer, per claim 33). [0027]



11. This material meets the requirements of Applicant's formula (1) where Z_1 is an aromatic heterocyclic ring (6-membered, per claim 2), Z_2 is an aromatic hydrocarbon ring (6-membered, per claim 3), and Z_3 is a single bond (per claim 4). R_{101} is a heteroaryl group. The molecular weight is 487.6 (per claim 5).

12. Concerning claim 36, Iwakuma et al. disclose that organic EL devices are useful for applications such as full color displays. [0002] In fact, it is the fundamental goal of research in organic electroluminescence to produce display devices. Therefore one of ordinary skill would immediately envisage display devices using the electroluminescent devices described by Iwakuma et al.

13. Applicant cannot rely upon the foreign priority papers to overcome this rejection because a translation of said papers has not been made of record in accordance with 37 CFR 1.55. See MPEP § 201.15.

Claim Rejections - 35 USC § 103

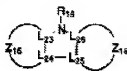
14. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

15. Claims 1-4, 8, 16, 32, 36 rejected under 35 U.S.C. 103(a) as being unpatentable over Ueda et al. (JP 2001-160488) in view of Shoustikov et al. (IEEE Journal of Selected Topics in Quantum Electronics, vol. 4, no. 1, pp. 3-13, Jan/Feb 1998) and Baldo et al. (Pure and Applied Chemistry, vol. 71, no. 11, pp. 2095-2106, 1999).

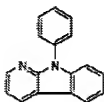
16. Concerning claims 1-4, Ueda et al. describe organic electroluminescent devices comprising a pair of electrodes and an organic layer comprising a fluorescent light emitting material having the general structure shown below. [0028], [0097]-[0098]

一般式(XII)

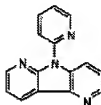


where Z₁₅ is an aromatic heterocycle, specifically including pyridine [0046] and Z₁₆ is an aromatic heterocycle or aromatic hydrocarbon, where the heterocycle also includes pyridine [0047]. R₁₆ includes hydrogen or a substituent [0029], including alkyl, cycloalkyl, aralkyl, aryl, , alkoxy among others. [0048] Ueda et al. give several specific examples, (XVII-1 to XVII-8, column 52-53) which illustrate that the position of the nitrogen atoms in the ring Z₁₅ and Z₁₆ are not critical to the function of the molecule as an electroluminescent material. (column 52-53)

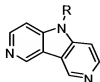
XVII-4



XVII-5



17. Furthermore, given the general teaching azacarbazole analogs such as those shown below, are also included. (per claim 8)



18. These compounds meet the requirements of Applicants formula (1) where Z₁ and Z₂ are both 6-membered rings (per claims 2-3), and where Z₃ is a single bond (per claim 4).

19. Since the materials function as a light emitting material (in a light emitting layer, per claim 32) in an organic electroluminescent device, it must inherently possess some charge transporting capability, and emits light, so is capable of forming an exciton from a hole-electron pair.

20. Ueda et al. are silent on the use of the material with a phosphorescent light emitting material.

21. However, it is well known to dope small amounts of dye molecules into an organic light emitting diode to produce significant changes in color and an improvements in device properties, such as quantum efficiency, lifetime etc. as described by Shoustikov et al. (Abstract, and column 2, page 3). Shoustikov et al. describe the process of energy transfer from a host material to a dopant material to change the color of light emission including Förster or Dexter energy transfer processes, but are silent on the use of phosphorescent materials.

22. Baldo et al. describes the use of phosphorescent materials as dye dopants in organic electroluminescent devices, which also use Förster or Dexter energy transfer processes (see page 2096), to produce excitation, and allow for the use of both singlet and triplet excited states, in comparison with fluorescence doping, which only allows singlet excited states (see page 2095). Phosphorescent materials are doped into a host material resulting in emission either by direct carrier trapping or by exciton formation in the host and energy transfer to the luminescent guest. (See page 2096, first paragraph).

23. Given these teachings, it would have been obvious to one of ordinary skill in the art to dope the fluorescent materials described by Ueda et al. with phosphorescent

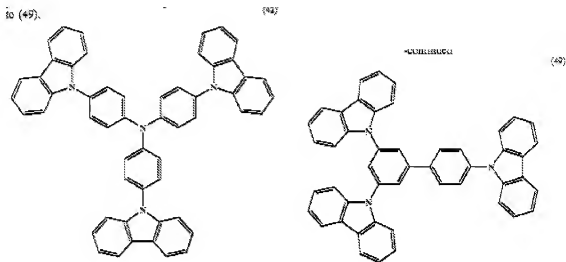
emitting materials for the purpose of changing the emission color, improving the efficiency and allowing for the use of both singlet and excited triplet states.

24. Concerning claim 36, Ueda et al. describe the organic electroluminescent devices discussed above. It is the fundamental goal of research into organic electroluminescent devices to incorporate them into display devices. As such, it would have been obvious to one of ordinary skill in the art to use the devices described by Ueda et al. in a display device.

25. Claims 1-5, 16, 18, 32, 34, and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hosokawa (US 6,660,410) in view of Noguchi et al. (EP 517542).

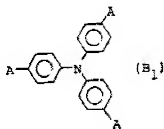
26. Concerning claims 1, 34, and 36, Hosokawa et al. describe organic electroluminescent devices comprising a pair of electrodes, and a light emitting layer having a carbazole derivative and a phosphorescent dopant in the light emitting layer. (abstract) Hosokawa et al. further disclose that by setting the triplet energy of the carbazole derivative to a value of $22,500\text{ cm}^{-1}$ or more, blue luminescence can be obtained easily (per claim 34). (column 7, lines 15-17) Hosokawa discloses that EL devices in general are suitable for use in display devices (per claims 36). (column 1, lines 22-25)

27. Hosokawa describes several carbazole derivatives suitable as host materials, including the specific structures shown below, among others.

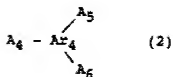


28. Hosokawa is silent on the use of aza-carbazole derivatives as the carbazole host material.

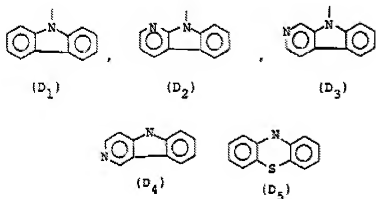
29. Noguchi et al. describes charge transport materials for electroluminescent devices, specifically materials having the general structures shown below (page 6)



as well as compounds having the general structure shown below, where Ar₄ includes specifically 3,5,4'-biphenyltriyl. (page 5, lines 28-32)



Wherein A represents one of the groups represented by the structures shown below.

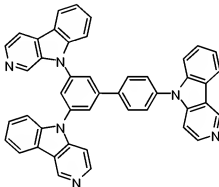


30. Noguchi et al. discloses the use of the charge transport materials in combination with a luminescent material in the light emitting layer. (abstract Page 3, lines 37-38)

31. It is clear that Hosokawa and Noguchi et al. describe the same carbazole containing material, and that Noguchi et al. further discloses aza-carbazole analogs suitable for use in electroluminescent devices, even in combination with light emitting materials. Given the structural similarity between the compounds, and the fact that aza-carbazole structures are described by Noguchi et al. equivalently with carbazole structures, it would be reasonable to predict that the aza-carbazole materials disclosed by Noguchi et al. would function in the same manner as the carbazole materials described by Hosokawa. It would have been obvious to one of ordinary skill, given the teachings of Hosokawa and Noguchi et al. to use the aza-carbazole compounds described by Noguchi et al. as the host material for phosphorescent dopants, in the light emitting layer (per claim 6) of the device described by Hosokawa. It would likewise

have been obvious to one of ordinary skill in the art to select a material having of 22,500 cm^{-1} or more for the purpose of producing blue emission.

32. For clarity, an example of the material described by Noguchi et al. is shown below.



33. Concerning claims 1-5, 16 and 18, the material shown above corresponds to Applicant's formula (1), where Z_1 and Z_2 are both 6-membered rings (per claims 2-3), and where Z_3 is a single bond (per claim 4). The molecular weight is 652.7 (per claim 5). R_{101} is an aryl group (specifically biphenyl (per claim 18)), and the azacarbazole ring is the same as formula (2-5) (per claim 16).

34. Claim 33 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hosokawa (US 6,660,410) and Noguchi et al. (EP 517542) as applied to claim 1 above, and further in view of Wakimoto et al. (US 2001/0043044).

35. Concerning claim 33, Hosokawa describes the organic electroluminescent device discussed above. Hosokawa further discloses the use of a hole blocking layer (hole barrier layer) to improve the capability of confining holes in the luminescence layer, give

a high luminescence brightness and attain a low driving voltage (column 24, lines 62-67). Hosokawa describes the use of phenanthroline compounds for this purpose.

36. Wakimoto et al. describes organic electroluminescent devices comprising a pair of electrodes, a luminescent layer, and a hole blocking layer, where between the light emitting layer and the hole blocking layer is a mixed layer comprising the material of the light emitting layer and the hole blocking layer. (abstract) Wakimoto et al. discloses that the use of the mixed layer increases the lifetime of the device, and prevents mutual diffusion of the hole blocking layer and adjacent layers due to heat generated during the driving of the EL element. [0042]

37. Given this teaching, it would have been obvious to one of ordinary skill in the art to use the host material described by Hosokawa and Noguchi et al. in the hole blocking layer, in combination with the hole blocking layer material for the purpose of increasing the lifetime of the device and preventing mutual diffusion of the hole blocking layer and adjacent layers due to heat generated during the driving of the EL element.

38. Claim 35 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hosokawa (US 6,660,410) and Noguchi et al. (EP 517542) as applied to claim 1 above, and further in view of D'Andrade et al. (2002/0197511).

39. Concerning claim 35, Hosokawa describes the organic electroluminescent device with a phosphorescent material in a high glass transition host material. Hosokawa is silent on the formation of a white device.

40. D'Andrade et al. describe an electroluminescent device comprised of a pair of electrodes, and a light emitting layer (in this case comprised of 3 sublayers), (fig. 9) where each of the sublayers is comprised of a host and a phosphorescent dopant which when combined emits **white** light based on phosphorescence (claim 2). D'Andrade et al. discloses that white organic light emitting devices are of interest because they offer low-cost alternatives for backlights in flat-panel displays and may find use in room or area lighting. [0005]

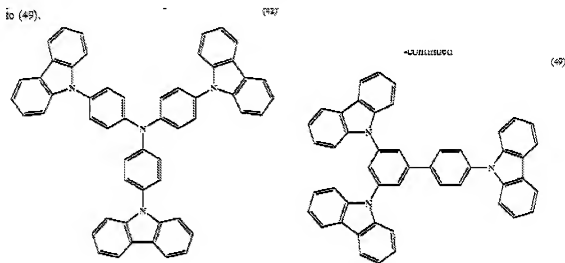
41. Given this teaching, it would have been obvious to one of ordinary skill in the art to use the sublayer doped light emitting layer described by D'Andrade et al. in the electroluminescent device described by Hosokawa et al. and the host material described by Noguchi et al. for the purpose of producing a white organic light emitting device.

42. Claims 1-5, 8, 16, 18, 32, 34, and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hosokawa (US 6,660,410) in view of Noguchi et al. (EP 517542) and Ueda et al. (JP 2001-016048) with evidence supplied by Wieczorek et al. (Archivum Immunologiae et Therapiae Experimentalis, vol. 34, no. 3, pp. 323-326, 1986).

43. Concerning claims 1, 34, and 36, Hosokawa et al. describe organic electroluminescent devices comprising a pair of electrodes, and a light emitting layer having a carbazole derivative and a phosphorescent dopant in the light emitting layer. (abstract) Hosokawa et al. further disclose that by setting the triplet energy of the

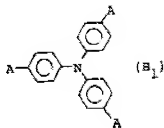
carbazole derivative to a value of $22,500 \text{ cm}^{-1}$ or more, blue luminescence can be obtained easily (per claim 34). (column 7, lines 15-17) Hosokawa discloses that EL devices in general are suitable for use in display devices (per claims 36). (column 1, lines 22-25)

44. Hosokawa describes several carbazole derivatives suitable as host materials, including the specific structures shown below, among others.

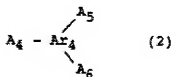


45. Hosokawa is silent on the use of aza-carbazole derivatives as the carbazole host material.

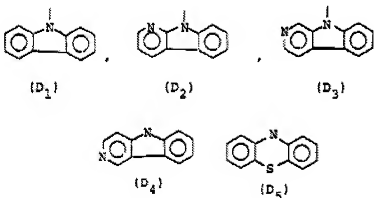
46. Noguchi et al. describes charge transport materials for electroluminescent devices, specifically materials having the general structures shown below (page 6)



as well as compounds having the general structure shown below, where Ar_4 including specifically 3,5,4'-biphenyltriyl. (page 5, lines 28-32)



Wherein A represents one of the groups represented by the structures shown below.



47. Noguchi et al. discloses the use of the charge transport materials in combination with a luminescent material in the light emitting layer. (abstract Page 3, lines 37-38)

48. It is clear that Hosokawa and Noguchi et al. describe the same carbazole containing material, and that Noguchi et al. further discloses aza-carbazole analogs suitable for use in electroluminescent devices, even in combination with light emitting materials. Given the structural similarity between the compounds, and the fact that aza-carbazole structures are described by Noguchi et al. equivalently with carbazole structures, it would be reasonable to predict that the aza-carbazole materials disclosed

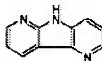
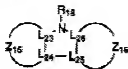
by Noguchi et al. would function in the same manner as the carbazole materials described by Hosokawa. It would have been obvious to one of ordinary skill, given the teachings of Hosokawa and Noguchi et al. to use the aza-carbazole compounds described by Noguchi et al. as the host material for phosphorescent dopants, in the light emitting layer (per claim 6) of the device described by Hosokawa. It would likewise have been obvious to one of ordinary skill in the art to select a material having of 22,500 cm^{-1} or more for the purpose of producing blue emission.

49. Noguchi et al. are silent on compounds which have a nitrogen in both rings of the aza-carbazole analog.

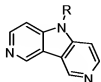
50. Ueda et al. describe electroluminescent devices wherein at least one layer of the device incorporates a molecule of the following general formula [0028] where Z_{15} is an aromatic heterocycle, specifically including pyridine [0046] and Z_{16} is an aromatic heterocycle or aromatic hydrocarbon, where the heterocycle also includes pyridine [0047]. Ueda et al. give several specific examples, (XVII-1 to XVII-8) which illustrate that the position and number of the nitrogen atoms in the ring Z_{15} and Z_{16} are not critical to the function of the molecule as an electroluminescent material.

XVII-3

一般式(XII)



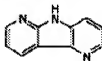
51. Given the teaching, and the examples, the following aza-carbazole is also envisaged.



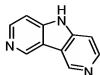
52. Given the close similarity in structure between the compounds described by Ueda et al., and the carbazole analogs described by Noguchi et al., which differ only an extra nitrogen atom in the ring, it would be reasonable to predict that a compound using the aza-carbazole analogs described by Ueda et al. would maintain their utility as charge transporting materials, and furthermore as host materials for a phosphorescent dopant, as described by Hosokawa et al., especially since the carbazole analogs described by Ueda et al. are fluorescent emitting compounds themselves.

53. Given the combined teachings, it would have been obvious to one of ordinary skill in the art to use the carbazole analogs described by Ueda et al. in compounds having a core structure described by Noguchi et al., and to use those materials as host materials for a phosphorescent emitting material. The necessary materials for synthesis of the analogs described by Noguchi et al. are disclosed by Ueda et al. For example, the material shown below, disclosed by Ueda et al. could be used to synthesize the analogs described.

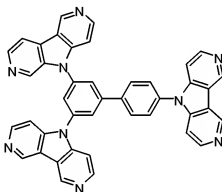
XVII-3



54. The analogous precursor shown below, is known in the art of Organic Synthesis, as evidenced by Wieczorek et al.



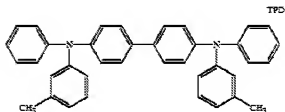
55. Concerning claims 1-5, 8, 16, and 18, an example of a compound discussed is shown below.



56. The material shown corresponds to Applicant's formula (1), where Z_1 and Z_2 are both 6-membered rings (per claims 2-3), and Z_3 is a single bond (per claim 3). The molecular weight is 655.7 (per claim 5). R_{101} is an aryl group (specifically biphenyl (per claim 18), and the aza-carbazole ring is the same as formula (1-3) and (2-3) (per claims 8 and 16).

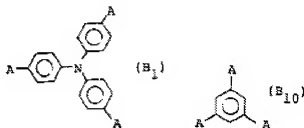
57. Claims 1-5, 16, 18, 32, 34, and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Adachi et al. (US 6,458,475) in view of Noguchi et al. (EP 517542).

58. Concerning claims 1, 34 and 36, Adachi et al. describes organic electroluminescent devices using a blue phosphorescent molecule as an emitter. (title) An example of such a device comprises a pair of electrodes, and a light emitting layer comprising the blue phosphorescent emitter (per claim 34) with a host compound (TPD, shown below). The hole transporting layer is also composed of TPD. (see example 2, column 15, lines 40-61) Adachi et al. discloses that the OLED's are useful in any type of devices (per claims 36) (column 16, lines 34-39)

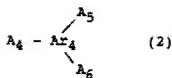


59. Adachi et al. are silent on the use of aza-carbazole compounds as the hole transporting material or host material.

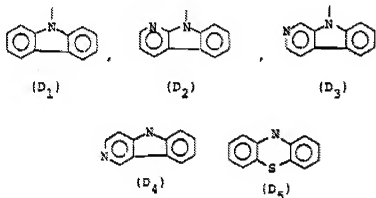
60. Noguchi et al. describes charge transport materials for electroluminescent devices, specifically materials having the general structures shown on pages 6 and 7, including the core structures shown below.



as well as compounds having the general structure shown below, where Ar₄ including specifically 3,5,4'-biphenyltriyl. (page 5, lines 28-32)



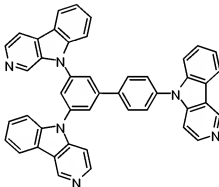
Wherein A represents one of the groups represented by the structures shown below.



61. Noguchi et al. discloses the use of the charge transport materials in combination with a luminescent material in the light emitting layer. (abstract Page 3, lines 37-38)
62. Noguchi et al. disclose that materials of this type form films improving the thermal stability and uniformity of light emission in the organic EL device (page 3, lines 26-33). Noguchi et al. compare the materials described to the known charge transport material TPD (See Comparative Example 1 and 2). Noguchi et al. disclose that the devices using the materials described had greater stability at elevated temperature compared with TPD.
63. Given this teaching, it would have been obvious to one of ordinary skill in the art to use the materials described by Noguchi et al. as the hole transport material, or

charge transporting host material of the device described by Adachi et al. for the purpose of increasing the stability at elevated temperature.

64. For clarity, an example of the material described by Noguchi et al. is shown below.



65. Concerning claims 1-5, 16 and 18, the material shown above corresponds to Applicant's formula (1), where Z_1 and Z_2 are both 6-membered rings (per claims 2-3), and where Z_3 is a single bond (per claim 4). The molecular weight is 652.7 (per claim 5). R_{101} is an aryl group (specifically biphenyl (per claim 18)), and the azacarbazole ring is the same as formula (2-5) (per claim 16).

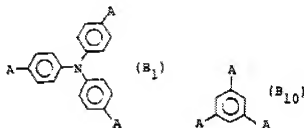
66. Claims 1-5, 16, 18, and 35-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over D'Andrade et al. (2002/0197511) in view of Noguchi et al. (EP 517542).

67. Concerning claims 1, 35-36, D'Andrade et al. describe an electroluminescent device comprised of a pair of electrodes, and a light emitting layer (in this case comprised of 3 sublayers), (fig. 9) where each of the sublayers is comprised of a host (CBP) and a phosphorescent dopant which when combined emits **white** light (per claim

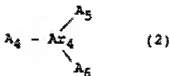
35) based on phosphorescence (claim 2). The device further includes a hole transport layer (Fig. 5) utilizing TPD [0044]. D'Andrade et al. discloses that white organic light emitting devices are of interest because they offer low-cost alternatives for backlights in flat-panel displays (per claim 36) and may find use in room or area lighting. [0005]

68. D'Andrade et al. are silent on the use of aza-carbazole compounds as the hole transporting material.

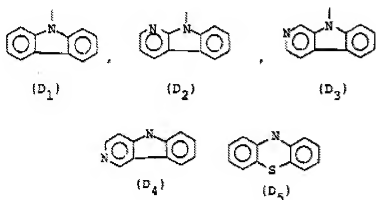
69. Noguchi et al. describes charge transport materials for electroluminescent devices, specifically materials having the general structures shown on pages 6 and 7, including the core structures shown below.



as well as compounds having the general structure shown below, where Ar₄ including specifically 3,5,4'-biphenyltriyl. (page 5, lines 28-32)



Wherein A represents one of the groups represented by the structures shown below.

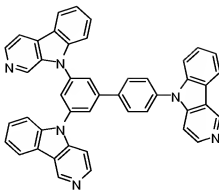


70. Noguchi et al. disclose that materials of this type form films improving the thermal stability and uniformity of light emission in the organic EL device (page 3, lines 26-33).

Noguchi et al. compare the materials described to the known charge transport material TPD (See Comparative Example 1 and 2). Noguchi et al. disclose that the devices using the materials described had greater stability at elevated temperature compared with TPD.

71. Given this teaching, it would have been obvious to one of ordinary skill in the art to use the materials described by Noguchi et al. as the hole transport material of the device described by D'Andrade et al. for the purpose of increasing the stability at elevated temperature.

72. For clarity, an example of the material described by Noguchi et al. is shown below.

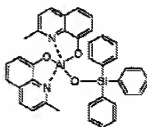


73. Concerning claims 1-5, 16 and 18, the material shown above corresponds to Applicant's formula (1), where Z_1 and Z_2 are both 6-membered rings (per claims 2-3), and where Z_3 is a single bond (per claim 4). The molecular weight is 652.7 (per claim 5). R_{101} is an aryl group (specifically biphenyl (per claim 18), and the azacarbazole ring is the same as formula (2-5) (per claim 16).

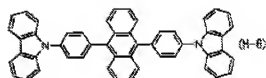
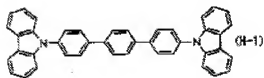
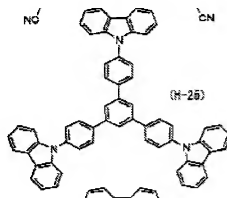
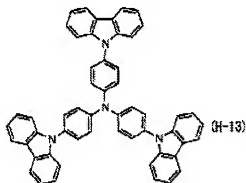
74. Claims 1-5, 16, 33 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al. (JP 2002-008860) (Sato '860) in view of Sato et al. (JP 2003-031371) (Sato '371) and Noguchi et al. (EP 517542) with evidence supplied by Thelakkat et al. (Polymers for Advanced Technologies, vol. 9, pp. 429-442, 1998).

75. Concerning claims 1, and 36, (Sato '860) describe an organic electroluminescent element with a pair of electrodes (2 and 8) and a light emitting layer (5) comprising a phosphorescent light emitting material and phenylcarbazole host. (Fig 1, abstract) The device further includes a hole blocking layer (6) comprising the material shown below. (See examples, [0083]) Sato '860 discloses that the devices are useful in flat panel displays, such as OA computers and flat TV. [0094]

39



76. Sato '860 is silent on the use of other materials for the hole blocking layer.
77. Sato '371 describe the use of a hole blocking layer to convey efficiently the electron from the cathode, and prevent the electron hole from passing through the luminous layer [0009], and that the use of N-phenyl carbazole type materials as a hole blocking material produce devices with high color purity and excellent in driving stability [0018]
78. Sato '371 discloses materials such as the ones shown below as useful for the hole blocking layer.

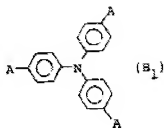


79. Sato '371 discloses the use of the material as a hole blocking material when the material has an ionization potential 0.1 eV or greater than the ionization potential of a host material in the light emitting layer. [0018] Sato '371 compare the use of the carbazole containing hole blocking material with the same hole blocking materials described by Sato '860 (See comparative example 2, [0124]-[126]) and disclose that the device has a large brightness and lacks driving stability compared to the carbazole material as hole blocking material. [0125]

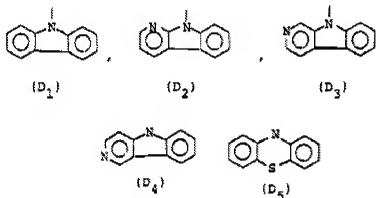
80. Given this teaching, it would have been obvious to one of ordinary skill in the art to use the materials described by Sato '371 in a hole blocking layer between the light emitting layer and the cathode of a device described by Sato '860 for the purpose of reducing the brightness degradation and improving the driving stability.

81. Sato '371 are silent on the use of aza-carbazole analogs of the carbazole materials in the hole blocking layer, but recognize that the ionization potential of the hole blocking material must be greater than the ionization potential of the host material in the light emitting layer.

82. Noguchi et al. describes charge transport materials for electroluminescent devices, specifically materials having the general structures shown below. (page 6) Noguchi et al. discloses the use of the charge transport materials in combination with a luminescent material in the light emitting layer. (abstract Page 3, lines 37-38)



Wherein A represents one of the groups represented by the structures shown below.



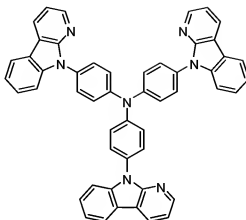
83. It is clear that Sato '371 and Noguchi et al. describe the same carbazole containing material, and that Noguchi et al. further discloses aza-carbazole analogs suitable for use in electroluminescent devices. Given the structural similarity between the compounds, and the fact that aza-carbazole structures are described by Noguchi et al. equivalently with carbazole structures, it would be reasonable to predict that the materials would function in the same manner as hole blocking materials.

84. Thelakkat et al. teach that compounds which are suitable as electron transport/hole-blocking materials, and for blocking the flow of holes towards the cathode, the molecule should have a low HOMO level, (particularly when compared with the adjacent hole-transporting/host layer) which inhibits hole transport. Thelakkat et al.

teach that potential candidates as electron transport materials are π -electron deficient nitrogen or oxygen containing heterocycles, including pyridines (page 430).

85. Since the compounds described by Noguchi et al. can essentially be considered to be pyridine analogs of carbazole, and compared with the structure of the closely related carbazoles (also described by Noguchi et al. and Sato '371), it is apparent that the azocarbazole compounds are more π -electron deficient than carbazole (resulting in a higher ionization potential), and would therefore be an obvious candidate for use in a hole blocking layer, since the hole transport capability would be reasonably predicted to be less than the adjacent carbazole containing layer, due to the presence of extra nitrogen atoms in the heterocyclic structure. It would therefore have been obvious to one of ordinary skill in the art to use the azacarbazole compounds described by Noguchi et al. and azacarbazole analogs of the materials described by Sato '371 in the hole blocking layer in a device as described by Sato '860, since they would be predicted have increased stability, as described by Noguchi et al. and Sato '371, and have a higher ionization potential than the adjacent host material, as required by Sato '371.

86. For clarity, an example of the material described by Noguchi et al. is shown below.

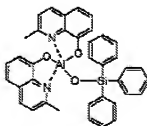


87. Concerning claims 1-5, 16 and 18, the material shown above corresponds to Applicant's formula (1), where Z_1 and Z_2 are both 6-membered rings (per claims 2-3), and where Z_3 is a single bond (per claim 4) R_{101} is an aryl group (per claim 18), and the azacarbazole ring is the same as formula (2-5) (per claim 16) The molecular weight is 743.9 (per claim 5).

88. Claims 1-5, 16, 33 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al. (JP 2002-008860) (Sato '860) in view of Sato et al. (JP 2003-031371) (Sato '371) and Noguchi et al. (EP 517542) and Ueda et al. (JP 2001-016048) with evidence supplied by Thelakkat et al. (Polymers for Advanced Technologies, vol. 9, pp. 429-442, 1998). and Ueda et al. (JP 2001-016048).

89. Concerning claims 1, and 36, (Sato '860) describe an organic electroluminescent element with a pair of electrodes (2 and 8) and a light emitting layer (5) comprising a phosphorescent light emitting material and phenylcarbazole host. (Fig 1, abstract) The device further includes a hole blocking layer (6) comprising the material shown below.

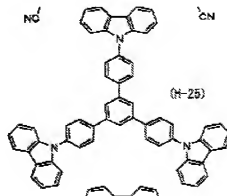
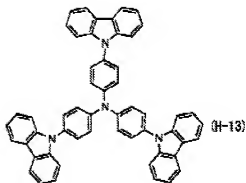
(See examples, [0083]) Sato '860 discloses that the devices are useful in flat panel displays, such as OA computers and flat TV (per claim 36). [0094]

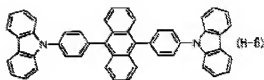
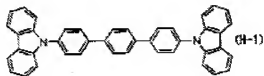


90. Sato '860 are silent on the use of other materials for the hole blocking layer.

91. Sato '371 describe the use of a hole blocking layer to convey efficiently the electron from the cathode, and prevent the electron hole from passing through the luminous layer [0009], and that the use of N-phenyl carbazole type materials as a hole blocking material produce devices with high color purity and excellent in driving stability [0018]

92. Sato '371 discloses materials such as the ones shown below as useful for the hole blocking layer.



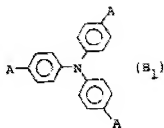


93. Sato '371 discloses the use of the material as a hole blocking material when the material has an ionization potential 0.1 eV or greater than the ionization potential of a host material in the light emitting layer. [0018] Sato '371 compare the use of the carbazole containing hole blocking material with the same hole blocking materials described by Sato '860 (See comparative example 2, [0124]-[126]) and disclose that the device has a large brightness and lacks driving stability compared to the carbazole material as hole blocking material. [0125]

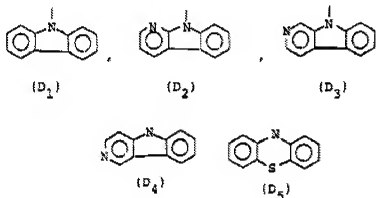
94. Given this teaching, it would have been obvious to one of ordinary skill in the art to use the materials described by Sato '371 in a hole blocking layer between the light emitting layer and the cathode of a device described by Sato '860 for the purpose of reducing the brightness degradation and improving the driving stability.

95. Sato '371 are silent on the use of aza-carbazole analogs of the carbazole materials in the hole blocking layer, but recognize that the ionization potential of the hole blocking material must be greater than the ionization potential of the host material in the light emitting layer.

96. Noguchi et al. describes charge transport materials for electroluminescent devices, specifically materials having the general structures shown below. (page 6) Noguchi et al. discloses the use of the charge transport materials in combination with a luminescent material in the light emitting layer. (abstract Page 3, lines 37-38)



Wherein A represents one of the groups represented by the structures shown below.

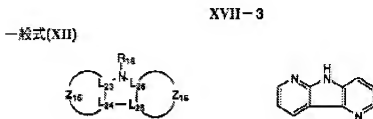


97. It is clear that Sato '371 and Noguchi et al. describe the same carbazole containing material, and that Noguchi et al. further discloses aza-carbazole analogs suitable for use in electroluminescent devices. Given the structural similarity between the compounds, and the fact that aza-carbazole structures are described by Noguchi et al. equivalently with carbazole structures, it would be reasonable to predict that the materials would function in the same manner as hole blocking materials.

98. Noguchi et al. are silent on compounds which have nitrogen in both rings of the aza-carbazole analog.

99. Ueda et al. describe electroluminescent devices wherein at least one layer of the device incorporates a molecule of the following general formula [0028] where Z₁₅ is an

aromatic heterocycle, specifically including pyridine [0046] and Z_{16} is an aromatic heterocycle or aromatic hydrocarbon, where the heterocycle also includes pyridine [0047]. Ueda et al. give several specific examples, (XVII-1 to XVII-8) which illustrate that the position and number of the nitrogen atoms in the ring Z_{15} and Z_{16} are not critical to the function of the molecule as an electroluminescent material.



100. Given the teaching, and the examples, the following aza-carbazole is also envisaged.



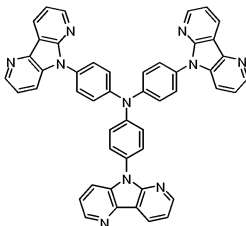
101. Thelakkat et al. teach that compounds which are suitable as electron transport/hole-blocking materials, and that for blocking the flow of holes towards the cathode, the molecule should have a low HOMO level, (particularly when compared with the adjacent hole-transporting/host layer) which inhibits hole transport. Thelakkat et al. teach that potential candidates as electron transport materials are π -electron deficient nitrogen or oxygen containing heterocycles, including pyridines (page 430).

102. Since the compounds described by Noguchi et al. can essentially be considered to be pyridine analogs of carbazole, and compared with the structure of the closely

related carbazoles (also described by Noguchi et al. and Sato '371), it is apparent that the azocarbazole compounds are more π -electron deficient than carbazole (resulting in a higher ionization potential), and would therefore be an obvious candidate for use in a hole blocking layer, since the hole transport capability would be reasonably predicted to be less than the adjacent carbazole containing layer, due to the presence of extra nitrogen atoms in the heterocyclic structure. It would therefore have been obvious to one of ordinary skill in the art to use the azacarbazole compounds described by Noguchi et al. and azacarbazole analogs of the materials described by Sato '371 in the hole blocking layer in a device as described by Sato '860, since they would be predicted have increased stability, as described by Noguchi et al. and Sato '371, and have a higher ionization potential than the adjacent host material, as required by Sato '371.

103. Given the close similarity in structure between the compounds described by Ueda et al., and the carbazole analogs described by Noguchi et al., which differ only an extra nitrogen atom in the ring, it would be reasonable to predict that a compound using the aza-carbazole analogs described by Ueda et al. would maintain the stability improvements described by Noguchi et al., it would therefore have been obvious to one of ordinary skill in the art to use the azacarbazole compounds described by Noguchi et al. and Ueda et al. and the di-azacarbazole analogs of the materials described by Sato '371 in the hole blocking layer in a device as described by Sato '860, since they would be predicted have increased stability, as described by Noguchi et al. and Sato '371, and have a higher ionization potential than the adjacent host material (due to the extra two nitrogen atoms in the carbazole heterocycle), as required by Sato '371.

104. For clarity, an example of the material described by Noguchi et al. is shown below.



105. Concerning claims 1-5, 16 and 18, the material shown above corresponds to Applicant's formula (1), where Z_1 and Z_2 are both 6-membered rings (per claims 2-3), and where Z_3 is a single bond (per claim 4) R_{101} is an aryl group (per claim 18), and the azacarbazole ring is the same as formula (2-5) (per claim 16) The molecular weight is 746.8 (per claim 5).

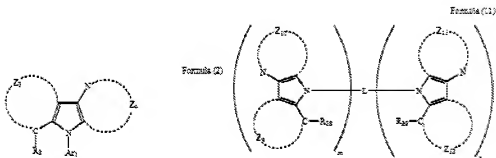
Double Patenting

106. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thornton*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

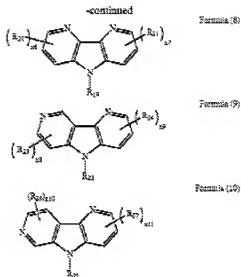
A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

107. Claims 1-5, 16, 18, 29, 33, and 35 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-2, 4, 6, 8-9, 12 of U.S. Patent No. 7,326,475 in view of D'Andrade et al. (2002/0197511). U.S. Patent No. 7,326,475 claims devices where a layer comprises material having the structures shown below, including structures with nitrogen atoms in both rings



including structures with nitrogen atoms in both rings, such as the structures shown below. Where L is a linking group, which encompasses biphenyl (per present claims 18 and 29).



108. The materials are used in the hole blocking layer (claim 4) of a device which produces white light (claim 6). The claims are silent on the use of a phosphorescent emitting layer in the device.

109. D'Andrade et al. describes white light emitting electroluminescent devices comprising a light emitting layer using phosphorescent emitting materials, and a hole blocking layer adjacent to the light emitting layer. D'Andrade et al. discloses that white organic light emitting devices are of interest because they offer low-cost alternatives for backlights in flat-panel displays and may find use in room or area lighting. [0005]

110. Given this teaching, it would have been obvious to use the materials described by the copending claims in the device described by D'Andrade et al. for the purpose of producing a white emitting device, and thus arrive at the present invention.

111. While the copending claims do not overlap with the elected species of the present invention, the claims do overlap with claims in the present invention which are

generic for the elected species, including the use of a biphenyl group as the linking group L, and di-azacarbazole analogs as illustrated above.

Response to Arguments

112. The declaration under 37 CFR 1.132 filed 08/21/2008 is sufficient to overcome the rejection of claim 29 based upon Adachi et al. and Ueda et al. The data are sufficient to support the use of the elected species, as well as species encompassed by claim 29, when compared with the closest prior art, given the improvements in device storage stability resulting from the use of the material of the invention.

113. Claim 29 would otherwise be allowable if written in independent form, except for double patenting issues, since the claim encompasses materials and uses which are claimed elsewhere, as discussed above.

114. However, the declaration does not support the full scope of the claims as written. The claims encompass a multitude of potential structures were not tested, and the results of the comparison can not be reasonably extended to the full scope of the claims as written. Compounds which are known in the art, such as those described by Ueda et al., Noguchi et al, and Iwakuma et al. fall within the scope of the claims as written, as discussed above. In many cases, the closest prior art to the inventive compounds in question is not CBP, as shown in the comparison, and in some cases, the increase in storage stability is not greater than the comparative example to such a degree as to show a significant improvement.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL E. NELSON whose telephone number is (571)270-3453. The examiner can normally be reached on M-F 7:30am-5:00pm EST (First Friday Off).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Callie Shosho can be reached on 571-272-1123. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Michael E. Nelson
Examiner
Art Unit 1794

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